SHAFTLESS COOLING FANS

FIELD OF THE INVENTION

[0001] This invention relates generally to cooling fans, more specifically, it relates to a shaftless cooling fan, in which an electromagnet is applied to interact with a permanent magnet in a fan body so as to rotate the fan body without needing any conductive contact or a shaft, thus to reduce the frictional resistance of the cooling fan.

BACKGROUND OF THE INVENTION

[0002] As the higher the operating speed of a computer is raised, the more the heat is generated in that computer, therefore, a delicate design of heat dissipation of computer is considered a very important factor to engineers.

[0003] For cooling the environment of computer in order to operate normally, one or more cooling fans are usually arranged in a computer for maintaining inside temperature under workable conditions. The cooling fan is generally comprised of a fan body pivotally jointed to a fan base through a shaft, where the shaft is rotatably fixed in the fan base by means of bearings or some other lubricating devices and electrically connected with an electrical device for driving the fan body.

[0004] In the foregoing fan structure, since the electrical connection for driving the fan body to rotate is made through the shaft, therefore the conventional jointing manner of the shaft with the fan base cannot be waived, and accordingly, nor can the frictional resistance be thoroughly eliminated. Moreover, just as the frictional resistance to a generic micro-mechanism, the heat generated from the frictional resistance is of equal importance to a notebook computer, which requires

a high efficiency of heat dissipation. And a final point to be emphasized is the assembling accuracy of the conventional fan structure. An assembling of low precision could result in an unsmooth rotation, vibration, or even impairment to the fan structure.

SUMMARY OF THE INVENTION

[0005] The primary objective of this invention is to provide a shaftless cooling fan for the purpose of improving the conventional fan structure.

[0006] In order to realize abovesaid objective, the shaftless cooling fan of this invention is comprised of a fan body pivotally mounted on a fan base through a configured shaft. The fan base has a plurality of vents, an electrical device for driving the fan body, a recess in its top and bottom ends for positioning a shaft end respectively, and a plurality of electromagnets surrounding the recess in the bottom end. The fan body is rotatably positioned in the fan base by placing the shaft ends in respective recesses, and there is also a plurality of permanent magnets aligned surrounding the lower shaft end. Every permanent magnet is comprised of a magnetic N-zone, an S-zone, and a Neutral zone, and repeated to form an annular structure. Every electromagnet is controlled by the electrical device to form magnetic zones corresponding to the N-zone, S-zone, and Neutral zone of each the permanent magnet. By arrangement in this way, each permanent magnet is driven to rotate the fan body by changing the magnetic zones in each electromagnet.

[0007] The merits of the shaftless cooling fan of this invention might be summarized as follows:

1. Since the shaft ends are rotatably point-contacted with the recesses without electrical connection, therefore the frictional resistance of shaft can be significantly reduced;

2. As the frictional resistance is reduced as described, the driving power required and heat generated can be accordingly lowered;

3. The rotation speed of the cooling fan can be raised accordingly because of the reduced frictional resistance;

4. The rotatable jointing of the shaft to the recess requires no high-precise assembling so that cost saving is possible; and

5. The rotatable jointing of the shaft to the recess in the manner of point-contact may simplify the assembling process.

[0008] For more detailed information regarding advantages or features of this invention, at least an example of preferred embodiment will be fully described below with reference to the annexed drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The related drawings in connection with the detailed description of this invention to be made later are described briefly as follows, in which:

Fig. 1 is a three-dimensional view showing the structure of a shaftless cooling fan of this invention;

Fig. 2 is a cutaway sectional view of the shaftless cooling fan of this invention;

Fig. 3 shows a schematic distribution diagram of magnetic poles of a permanent magnet and electromagnet in the shaftless cooling fan of this invention;

Fig. 4A is a schematic distribution diagram of magnetic poles showing the interactive force between the permanent magnet and the electromagnet in the shaftless cooling fan of this invention;

Fig. 4B is a schematic view showing the force exerted upon a magnetic N-zone of the permanent magnet in the shaftless cooling fan of this invention;

Fig. 4C is a schematic view showing the force exerted upon a magnetic S-zone of the permanent magnet in the shaftless cooling fan of this invention;

Fig. 5A is a schematic view showing an initial state of the shaftless cooling fan of this invention;

Fig. 5B is a schematic view showing another initial state of the shaftless cooling fan of this invention; and

Fig. 5C is a schematic view showing yet another initial state of the shaftless cooling fan of this invention.

DETAILED DESCRIPTION OF THE INVENTION

[0010] A preferred embodiment of shaftless cooling fan of this invention is mainly comprised of a fan body (1) installed on a fan base (2) as shown in Figs. 1 and 2.

[0011] The fan base (2) is substantially a square hollow casing having at least an opening formed in its top end and side wall, respectively. A recess (21) for positioning a shaft end is formed at respective corresponding positions of the lower surface of a top end and the upper surface of a bottom end in the fan base (2). Also, an electrical device (not shown) for driving the fan body (1) is arranged in the fan base (2) and extended to the upper surface of the bottom end of the fan base (2) to form a plurality of electromagnets (22), which is aligned surrounding the recess (21).

[0012] The fan body (1) is composed of a configured shaft (11) and a plurality of fan leaves (12) outwardly extended therefrom, in which the top and the bottom end of the configured shaft (11) are tapered into respective sharp ends (13) for being accommodated in the recess (21) individually to have the configured shaft (11) rotatably located in the fan base (2). In addition, a plurality of permanent magnets (14) is disposed surrounding the sharp ends (13) on the bottom face of the configured shaft

(11).

[0013] The contact face of the sharp end (13) of the configured shaft (11) in contact with the respective recess (21) is deemed as a point-contact.

[0014] Fig. 3 shows a schematic distribution diagram of magnetic poles of a permanent magnet and electromagnet in the shaftless cooling fan of this invention.

[0015] As shown in Fig. 3, the magnetic poles of the permanent magnets (14) on the bottom face of the configured shaft (11) are spaced equally and aligned annularly in a same circumferential direction to form intermittently inserted magnetic N-zones (14a), S-zones (14b), and Neutral zones (14c). Further, the electromagnets (22) in the fan base (2) are controlled by an electrical device for defining a plurality of annularly aligned magnetic zones (22a), in which each magnetic zone (22a) is annularly and repeatedly controlled to create a magnetic N-zone, an S-zone, and a Neutral zone cyclically, and is controlled by a clock to produce a Neutral zone, an S-zone, then an N-zone sequentially and rotationally. By the foregoing arrangement and the commutation of each magnetic zone (22a) of the electromagnets (22), every permanent magnet (14) on the bottom end of the configured shaft (11) is either repulsed or attracted to hence drive the configured shaft (11), and accordingly the fan body (1), to rotate.

[0016] Referring to Figs. 4A, 4B, and 4C and observing all the permanent magnets (14) and electromagnets (22) in an imaginary straight line, the periodically and cyclically appeared N-zones (14a), S-zones (14b), and Neutral zones (14c) of the permanent magnets (14) are assumedly zigzag aligned against that of the electromagnets (22) in an initial state. Therefore, every N-zone (14a) of the permanent magnet (14) is repulsed theoretically by the corresponding N-zones (22a) of the electromagnets (22) such that a resultant force is consequently formed to drive the

shaft (11) to rotate in a direction shown in Fig. 4B. Similarly, every S-zone (14b) of the permanent magnet (14) is repulsed theoretically by the corresponding S-zones (22a) of the electromagnets (22) such that a resultant force is consequently formed to drive the shaft (11) to rotate in a direction shown in Fig. 4C. Hence, the shaft (11) will rotate in a direction depending upon the total resultant force that exerts on the permanent magnets (14).

[0017] Then, after a short time is elapsed, the order of the magnetic zones (22a) of each electromagnet (22) is changed rotationally by way of: the original N-zone (22a) into a Neutral zone (22a), the original S-zone (22a) into an N-zone (22a), and the original Neutral zone (22a) into an S-zone (22a), so that the shaft (21) will rotate in the same direction. Therefore, under a proper means for controlling the magnetic zones of each electromagnet (22) in the order of a Neutral zone, an S-zone, then an N-zone, the shaft (11) could be kept in continuous rotation.

[0018] As indicated in Figs. 5A, 5B, and 5C, an initializing process is indispensable at the first place for starting a shaftless cooling fan of this invention for controlling the alignment of the magnetic zones (22a) of each electromagnet (22) in the order of a Neutral zone, then an S-zone, and followed by an N-zone, and holding that order for an optimum time period. As a result, in the initial state, an attractive force and a repulsive force from an S-zone (22a) of each electromagnet (22) are applied on every N-zone (14a) and S-zone (14b) of each permanent magnet (14), respectively, hence each N-zone (14a) of every permanent magnet (14) will be positioned right above an S-zone (22a) of each electromagnet (22). Then, the initializing process is going to dispense an N-zone and a Neutral zone to two immediate neighboring magnetic zones (22a) of The S-zone (22a) in each electromagnet (22), then change the magnetic zones sequentially in the order of a

Neutral zone, an S-zone, then an N-zone, so that the configured shaft (11) is driven to rotate continuously in the state as above-mentioned.

[0019] In the above described, at least one preferred embodiment has been described in detail with reference to the drawings annexed, and it is apparent that numerous changes or modifications may be made without departing from the true spirit and scope thereof, as set forth in the claims below.